

February 18, 2022

Revision 4



Call for Proposals Astrophysics Division Senior Review 2022

To: MSFC/ M.C. Weisskopf, Project Scientist, Chandra X-ray Observatory
CXC/ P. Slane, Director, Chandra X-ray Center
GSFC/ E. Hays, Project Scientist, Fermi Gamma-ray Space Telescope
GSFC/ J. Wiseman, Project Scientist, Hubble Space Telescope
AURA/ K. Sembach, Director, Space Telescope Science Institute
GSFC/ K. Gendreau, PI, NICER
JPL/ D. Stern, Project Scientist, NuSTAR
CIT/ F. Harrison, PI, NuSTAR
GSFC/ B. Cenko, PI, Neil Gehrels Swift Observatory
MIT/ G. Ricker, PI, TESS
GSFC/ P. Boyd, Project Scientist, TESS
GSFC/ K. Weaver, US Project Scientist, XMM-Newton
SWRI/ S. A. Stern, PI, New Horizons

From: NASA HQ/ E. P. Smith, Chief Scientist, APD, SMD
NASA HQ/ R. Cocks, Program Executive, APD, SMD

Subject: Call for Proposals – 2022 Senior Review of Astrophysics Division Operating Missions

Revision: Revision 1 released on November 29th, 2021 has updated name for budget summary spreadsheet and references in document made to be consistent with name: Appendix_A_mandatory_budget_summary_form.xlsx.
A question and answer log has also been added in Appendix B.

Revision 2 released on December 3rd, 2021 has a new section 6.4.4.3.3.1 pertaining to a one-time budget reduction, and modifications to sections 6.4.4.3.1 and 6.4.4.3.5 to make them consistent with section 6.4.4.3.3.1.

Revision 3 released on January 11th, 2022 has 6.4.4.3.3.1 removed.

Revision 4 released on February 18th, 2022 SOFIA removed from review and dates for review activities added.

1. Senior Review background

NASA's Science Mission Directorate (SMD) regularly conducts independent, comparative reviews of its operating missions. NASA uses the findings from these reviews to define an implementation strategy and give programmatic direction to the missions and projects concerned, for the next five fiscal years.

1.1 Governance

This review process is consistent with Section 304(a) of the NASA Authorization Act of 2005 (P.L. 109-155), and the NASA Transition Authorization Act of 2017 (P.L. 115-10), which modifies Section 51 U.S.C. §30504 to read:

(a) Assessments. —

(1) In general. —

The Administrator shall carry out triennial reviews within each of the Copy of 2022 Astrophysics Senior Review - Call for Proposals - Rev 3 - Google DocsScience divisions to assess the cost and benefits of extending the date of the termination of data collection for those missions that exceed their planned missions' lifetime.

(2) Considerations. —

In conducting an assessment under paragraph (1), the Administrator shall consider whether and how extending missions impacts the start of future missions.

(b) Consultation and Consideration of Potential Benefits of Instruments on Missions. —

When deciding whether to extend a mission that has an operational component, the Administrator shall—

(1) consult with any affected Federal agency; and

(2) take into account the potential benefits of instruments on missions that are beyond their planned mission lifetime.

(c) Reports. —

The Administrator shall submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Science, Space, and Technology of the House of Representatives, at the same time as the submission to Congress of the Administration's annual budget request for each fiscal year, a report detailing any assessment under subsection (a) that was carried out during the previous year.

1.2 Purpose

These reviews of operating missions are NASA's highest form of peer review, as the subject is not a single science investigation, or even a single space mission, but rather a portfolio of operating missions. The reviews of operating missions are referred to as Senior Reviews, in recognition of the high level of the peer review.

The NASA Astrophysics Division (APD) will host its next Senior Review (SR) of operating missions in 2022. The Senior Review assesses proposals for funding, usually involving additional resources in upcoming years, to continue operations of missions in the extended operations phase. The purpose of the review is to assist NASA in maximizing the scientific productivity and operating efficiency of the Astrophysics Division mission portfolio within the available funding. NASA will use the findings from the Senior Review to:

- Prioritize the operating missions and projects;
- Define an implementation approach to achieve astrophysics strategic objectives;
- Provide programmatic direction to the missions and projects concerned for FY23, FY24 and FY25; and
- Issue initial funding guidelines for FY26 and FY27 (to be revisited in the 2025 Senior Review).

NASA actions resulting from the Senior Review could include authorizing a mission to pass from its prime phase to extended phase; maintaining the status quo; significantly restructuring the project; or terminating an ongoing science mission.

1.3 Call for Proposals

This Call for Proposals describes the objectives and process for the review and contains instructions for the submission of proposals and presentations (in-person or virtual TBD) to the review panels.

2. Execution of the 2022 Senior Review

The execution of the 2022 Senior Review follows the assessment, prioritization, and NASA response to the 2019 Senior Review

(<http://science.nasa.gov/astrophysics/2019-senior-review-operating-missions/>). The following missions will be included in the 2022 Senior Review:

- Chandra X-ray Observatory (Chandra)
- Fermi Gamma-ray Space Telescope (Fermi)
- Hubble Space Telescope (Hubble)
- Neutron Star Interior Composition Explorer (NICER)
- New Horizons
- Nuclear Spectroscopic Telescope Array (NuSTAR)
- Neil Gehrels Swift Observatory (Swift)
- Transiting Exoplanet Survey Satellite (TESS)

- X-ray Multi-Mirror Mission-Newton (XMM-Newton)

2.1 Review composition and structure

The 2022 Astrophysics Senior Review will adopt a multi-level review structure (see figure 1 below), in which four panels report to a Senior Review Subcommittee, which will be established as a subordinate group to the Astrophysics Advisory Committee, consistent with the Charter of the Astrophysics Advisory Committee and compliant with the Federal Advisory Committee Act (FACA) of 1972 (P.L. 92-463).

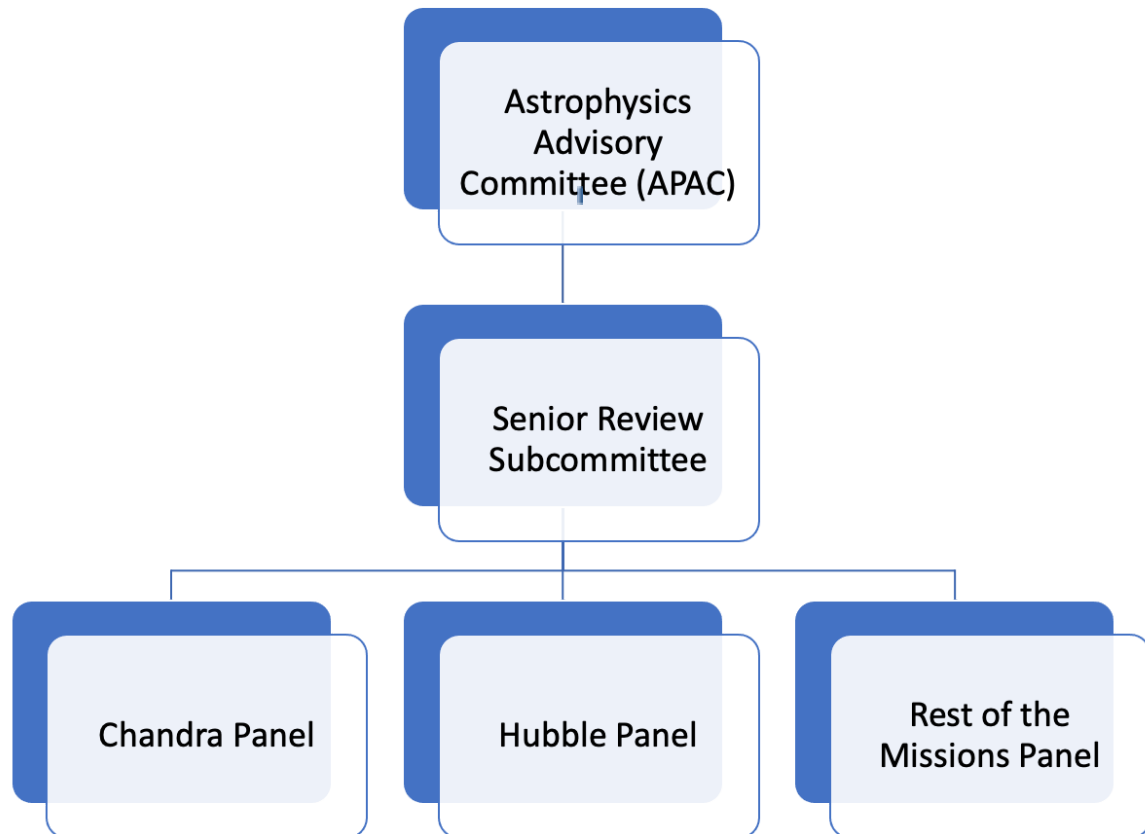


Figure 1: Multilevel review structure

2.2 Chandra and Hubble Panels

Consistent with the 2014, 2016 and 2019 Senior Reviews, there will be separate panels for Chandra and Hubble. This recognizes their status as astrophysics community facilities, as well as the scope and complexity of their operations.

The Senior Review Subcommittee will rank Chandra and Hubble alongside all the other missions (Section 2.4). As a result, not only will the panels assess the scientific merit, relevance and responsiveness to the division's strategic goals, and technical capability and cost reasonableness of Chandra and Hubble, but will place additional emphasis on their operations, science productivity given the costs, and efficiency.

2.3 The Rest-of-Missions Panel

The remaining missions (Fermi, NICER, New Horizons, NuSTAR, Swift, TESS, and XMM-Newton) will be reviewed by a single panel charged with assessing their scientific merit, relevance and responsiveness to the division's strategic goals, technical capability and science productivity given the costs.

2.4 The Senior Review Subcommittee

The Senior Review Subcommittee is a subcommittee under the APAC, and will operate in compliance with its Terms of Reference. Its principal role is to merge the findings from the Chandra, Hubble, and Rest-of-Missions Panels and to rank all missions on the review criteria provided in this Call for Proposals.

The Senior Review Subcommittee will write a report that includes a series of findings to assist with the Astrophysics implementation strategy for FY23-FY27, including an appropriate mix of:

- Continuation of projects at their in-guide level;
- continuation of projects with either enhancements or reductions to their in-guide budgets;
- mission extensions beyond the prime mission phase; and/or,
- termination of projects.

The membership of the Senior Review Subcommittee will be drawn from the Chandra, Hubble, and Rest-of-Missions panels. It will report to the APAC, and will not provide advice or work products directly to NASA. The Subcommittee Chair will report on the Subcommittee's recommendations and findings, as well as its work products, for public deliberation by the APAC. The final report of the Senior Review Subcommittee is a deliverable to the APAC.

2.5 The NASA Astrophysics Advisory Committee (APAC)

The APAC will publicly deliberate the Senior Review Report delivered by the Senior Review Subcommittee. The APAC will deliver a final report to NASA reflecting its formal recommendations to NASA, as well as append an unedited copy of the Senior Review Subcommittee's report.

3. Scope of Senior Review proposals

Each mission that is invited to the Senior Review shall submit a proposal outlining how its science investigations will benefit the Astrophysics Division's research objectives. These objectives and focus areas are described in the [SCIENCE 2020-2024: A Vision for Scientific Excellence](#) (the SMD Science Plan) and the 2020 Astrophysics Decadal Survey (when received). As described in this Call for Proposals, the three review criteria are: (1) scientific merit, (2) relevance and responsiveness to the Astrophysics

Division's strategic goals, and (3) technical capability, management and science productivity given the costs. Detailed instructions for the proposals are provided in the following Sections 6 and 7 below.

3.1 Prioritized mission objectives

For this review, projects are required to submit plans containing a set of Prioritized Mission Objectives (PMOs) for FY23-FY25, with a possible extension to FY26-FY27 aligned to the focus areas described in Section 6 and 7. These PMOs should elucidate the scientific, technical, and/or budgetary priorities for the upcoming five year planning cycle and allow the Senior Review Panel to make a comparative analysis amongst divergent mission needs and priorities for allocating available funding. This will allow NASA flexibility in planning within a dynamic budgetary environment. These prioritized objectives will also allow subsequent Senior Reviews to assess and measure the success of each mission in achieving its stated goals, as well as provide reporting inputs for the Agency.

For missions that are primarily driven by GO/GI-type investigations, the PMOs should focus on stewardship and efficiency. Even for these GO/GI-driven missions, however, a project may opt to state as a PMO the expected science return of one or more current or future 'key projects,' and/or the expected science return from other discretionary allocations of observing time.

4. Mission extension paradigm

Under this call, the budgets for mission extensions beyond the prime mission lifetime (in NPR 7120.5 parlance, Prime Phase E) will support, at a lower funding level, activities required to maintain operations and continue to produce meaningful and significant science data, which is adequately described and accessible to the researcher. When a mission has completed its Prime Phase E, the NASA Astrophysics Division may accept higher operational risk, lower data collection efficiency, and instrument/mission degradation due to aging. Priority is given to maintaining understanding of the instrument performance, to monitoring progress towards accomplishing the science objectives, and to involving and growing a diverse scientific community and building inclusive scientific environments to make the best scientific use of NASA's Astrophysics missions; however, more limited funding may be available in this "minimal-science data analysis mode" for detailed analysis, data fitting, modeling, and interpretation. This paradigm regarding lower funding levels, however, applies to the first mission extension only: it is not a requirement that a subsequent mission extension has a reduced operating cost over that which preceded it.

It is assumed that, along with this reduced funding profile and greater risk, the cost to implement will be lower than that of Prime Phase E. The Astrophysics Division sponsors several competitive programs that support basic research, theory, and data analysis.

5. Schedule for the 2022 Senior Review¹

Senior Review Activities	Date
Final Call for Proposals issued	September 30, 2021
Proposals due	February 11, 2022
Hubble panel meeting (virtual)	March 15, 16, 17, 2022
Rest-of-Missions panel (virtual)	March 29-April 1, 2022
Chandra panel meeting (virtual)	April 5, 6, 7, 2022
Panel reports delivered to Senior Review Subcommittee	April 15, 2022
Senior Review Subcommittee meeting in Washington, D.C.	May 4-5, 2022
Senior Review Subcommittee report delivered to APAC	May 6, 2022 (TBC)
Special APAC meeting	May TBD, 2022
NASA Response/Direction to projects	May-June 2022

6. Instructions to proposers (all missions)

Additional instructions for Chandra and Hubble are in Section 7.

6.1 Proposal preparation instructions

There are three overarching Astrophysics questions identified in the [SCIENCE 2020-2024: A Vision for Scientific Excellence](#) (the SMD Science Plan):

- How does the universe work?
- How did we get here?
- Are we alone?

These three questions form the basis of the three astrophysics science themes and map onto the 2020 Astrophysics Decadal Survey. Each project within the Astrophysics portfolio was chosen for its ability to shed insight into these areas. Each project should demonstrate in the Senior Review, therefore, how its activities can contribute to the vision of the Astrophysics Division, the goals of the SMD Science Plan, and the priorities of the ²2020 Astrophysics Decadal Survey.

¹ Mission panel meetings and site visits will be updated once arrangements are made. Virtual or on-site venues will be decided upon based on changing protocols and availability.

² Provided the 2020 Astrophysics Decadal Survey is released in time reasonable for its inclusion in the response.

6.2 Proposal focus areas

Proposals need to discuss the project's potential for advancing NASA's science objectives during the FY23 to FY27 timeframe. Proposals should address the following focus areas using PMOs identified for the next five year planning cycle:

1. Scientific merit of the project, its unique capabilities and relevance to the vision of the Astrophysics Division, the goals of the SMD Science Plan, and the priorities of the 2020 Astrophysics Decadal Survey. Missions with a comprehensive GO/GI program should be prepared to discuss the relative merits and scientific productivity given the costs of these programs compared to alternate sources of research funding within the Astrophysics Division Research & Analysis portfolio.
2. The promise of future impact and productivity (due to uniqueness of capabilities, wavelength coverage, etc.) Missions with GO/GI programs should be prepared to discuss the promise of those programs.
3. Progress made toward achieving the PMOs identified in the 2019 Senior Review proposal (for missions that were subject to the 2019 Senior Review);
4. Impact of past scientific results as evidenced by publications and citations (and other means) as well as demonstrating how these tie into future promise.
5. Project's plans to increase the diversity of thought and backgrounds represented and create inclusionary environments across the project, including within project leadership as well as across the project and the scientific community.
6. Broad accessibility, usability, and utility of the information, both as a unique mission, and in synergy with other missions in the Astrophysics portfolio, focusing on the cost efficiency, collection, archiving, and distribution of data, software, and publications.
7. Proposals must also include a set of PMOs for FY23-FY27, and a detailed description of how the PMOs will be accomplished.
8. Level and quality of observatory stewardship (e.g., maximizing the scientific return while minimizing the costs);
9. Spacecraft / Platform and instrument health and safety. List mission risks and proposed mitigations.

6.3 Proposal budget constraint

Consistent with the previous Senior Review, education, including science activation, is no longer a part of the operating missions' budgets, and any education activities funded by SMD outside of the operating missions' budgets will not be reviewed as part of the

Senior Review.

6.4. Required sections

The proposal shall contain the following sections:

- Science and Implementation
- Technical (including Health and Safety)
- Management
- Budget
- Project Data Management Plan
- Appendices (see Section 6.5)

The combined sections should not exceed 30 pages (including figures, figure captions, tables, and other graphics). Not included in the page limit are the appendices (see Section 6.5). Letters of endorsement are not needed for the Senior Review, and should not be included.

All pages are to be formatted on 8.5 x 11-inch paper, single-spaced, with 0.75 inch margins using a minimum of 11 point Arial font style (including for figure captions). The entire proposal, except budget spreadsheets, must be submitted electronically in PDF format; the budget must be submitted using the provided Excel format (which may be expanded upon as needed).

Should the home institution require signatures, please prepare these as a cover letter to the proposal. Copies of this submittal letter will not be used in the review but will be retained within the Astrophysics Division. Sufficient proposal identifiers including the project name and names of key writers or presenters shall be placed at the top of the first page.

6.4.2. Previous Senior Review proposals / reviews

2019 Senior Review proposals will be made available to the panel as appropriate. In order to assist the reviewers, the 2022 Senior Review proposal may explicitly address sections in the 2019 proposal, but it should remain a self-contained document.

6.4.3. Non-public documentation

Any non-public documents will be provided to the Senior Review panel under a non-disclosure arrangement.

6.4.4. Instructions for the proposal section

The following sections provide guidance for the material to be included in the proposal.

6.4.4.1. Science and implementation section

This section should focus on how the proposed science objectives will contribute to the state of knowledge of the discipline, their relevance to the research objectives and focus areas, as well as contributions to achieving the recommendations for the state of the profession in the areas of inclusion, diversity, equity and accessibility, thereby increasing the diversity of thought and backgrounds represented, as stated in the SMD Science Plan. This section should describe the focus areas 1-9 noted in Section 6.2.

6.4.4.2. Technical section

The section should begin with a discussion of the overall technical status of the components of the mission. This description should include the spacecraft or platform, instruments, and ground system including the spacecraft or platform control center and science center(s). The discussion should summarize the health of the components and point out limitations as a result of degradation, aging, use of consumables, obsolescence, etc. Any funding to Instrument Teams or other groups should be described and justified in detail. Projects are also instructed to show, in an appropriate summary manner, the anticipated 'in kind' support from NASA-funded sources other than the project's in-guide budget. These 'in kind' sources include tracking support from the NASA tracking networks and support from the multi-mission infrastructure projects at AFRC, ARC, GSFC, MSFC, JPL, and elsewhere. Representations of direct or in-kind funding from international partners, from other US Government agencies, or non-Government institutions should be provided separately, for informational purposes.

6.4.4.3. Management section

This section should address the suitability of the mission's operating model (e.g., governance, science team, instrument team(s)) to meet the proposed scientific goals, as well as contributions to achieving any relevant recommendations of the 2020 Astrophysics Decadal Survey, including the state of the profession as applicable, and increasing inclusion and the diversity of thought and backgrounds represented, as noted in the SMD Science Plan. Proposals should provide a narrative self-assessment of the level and quality of observatory stewardship, and discuss the project's plans to prepare for the future by providing leadership and development opportunities for a diverse workforce including training and mentoring for future mission leaders, as well as nurturing a diverse community and maintaining an inclusive scientific environment.

6.4.4.4. Budget section

This section should discuss the proposed budgets. Labor, major equipment, and other expenses for the in-guideline budget must be explained in sufficient detail to determine the merit and incremental cost of each proposed task. Labor costs should be explicitly sub-categorized as Civil Servant or Contractor. The proposed cost must represent the entire value of the project, including project expenditure, expenses paid by the Center, tracking networks (DSN, TDRSS, etc.), tail circuits, and multi-mission infrastructure

projects such as the Advanced Multi-mission Operations System (AMMOS) at JPL and the Space Science Mission Operations (SSMO) Project at GSFC. Missions are asked to separate the costs of obtaining, validating, calibrating, and archiving data from costs of completing scientific investigations with the data obtained.

6.4.4.3.1 Budget scenarios

Each project should provide a plan for at least the first, second and third of the following four budget scenarios: in-guide, under-guide and over-guide missions.

6.4.4.3.2 An “in-guide” plan (required)

Projects must present a plan for a budget consistent with the funding levels set in the April, 2021 NASA Astrophysics Planning, Programming, Budgeting, and Execution (PPBE) process. Each project must propose an in-guide plan, which follows the NASA Astrophysics budget guideline for the period under review. Where an out-year guideline is zero, projects must propose their most recent Astrophysics PPBE submission.

6.4.4.3.3 An “under-guide” plan (required)

Projects must present a plan and budget that would allow for continued operations at a level below their in-guide budgets. By identifying such a minimum acceptable funding level, the project is indicating that any further reduction is untenable, and that the project should be terminated rather than be funded at a level lower than the under-guide level. The science/technical/budget description of this scenario should address the reduced scope (impacts) compared to the in-guideline scenario. The difference in return (science, technical, spacecraft health and safety, etc.) compared to the in-guideline plan should also be clearly identified. If a project assesses the in-guide budget to already be the minimum level for continued operations, then this must be explicitly stated and justified in the proposal.

6.4.4.3.4 An “over-guide mission” plan (optional)

Projects may present an over-guide plan and budget if the proposed in-guide budget poses a significant (self-assessed) risk to the continued operations of the mission. The proposed over-guide budget should be included with full cognizance of the very tight fiscal constraints that NASA faces. In other words, this over-guide request should be a carefully considered request with appropriate justification, and not a maximal request. The description of this scenario should address the added scope and expected benefits compared to the in-guideline scenario. The added return (science, technical, spacecraft health and safety, etc.) from the over-guide versus the in-guideline plan should be clearly identified and justified. The budget section should explicitly detail the use of the additional requested funds. The added return should be clearly connected to the additional budget required (over the current NASA Astrophysics budget guideline) so that

the reviewers can evaluate none, some, or all of the added return and estimate the budget required for partially funding any proposed increases.

6.4.4.3.5 Additional budget requirements

The included spreadsheet contains instructions and the mandatory form for the budget portion of the proposal. This form serves as a standard budget spreadsheet for all proposals, and allows the panel to make the appropriate comparisons. Projects are required to submit a budget spreadsheet for each of the “in-guide,” “under-guide” and “over-guide” mission scenarios they propose.

For the period under consideration in this Senior Review, the budget should be itemized, as required in the spreadsheet, and described and justified in full detail in the technical/management/budget section. For each of the in-guide,” “under-guide,” “one-time reduction” and “over-guide” mission scenarios proposed, the project is required to submit Technical and Budgetary Prioritized Mission Objectives (PMOs) to facilitate the SR Panel’s ability to assess planned operating efficiencies and budgetary plans in accordance with the Extended Mission paradigm.

6.4.4.3.6 Budget summary form

Appendix A to this Call for Proposals provides the mandatory budget summary form with instructions and definitions. The budget spreadsheet provides tables for NASA-provided ‘in kind’ support and instrument team budgets; each proposal may include additional details in a format determined by each project.

6.4.5.5. Instructions for the Project Data Management Plan

Each project should provide a project data management plan (PDMP) as part of the proposal. The PDMP should include how the project is making scientifically useful data, software, publications, and other information produced by the project accessible in line with NASA’s Science Information Policy for the Science Mission Directorate (2021).

NASA’s Science Information Policy for the Science Mission Directorate (2021) provides details on requirements and best practices for archiving mission information. The PDMP should justify the reason for any variances from this policy and include any mitigating actions to be undertaken.

Projects are encouraged, but not required to, submit plans to further enhance the accessibility of the information being produced by the projects. These plans should be included in the over-guide section of the budget.

6.4.4.6. Required appendices

The following appendices are required and do not count against the proposal page limit, but in itself will be limited to 30 pages.

- References.
- Standard budget(s) in the mandatory format. The spreadsheet template in Appendix A to this Call for Proposals provides the mandatory summary format for the budget and supplies a spreadsheet template.
- A full designated list of all acronyms used in proposal.
- An online bibliography of recent publications with their number of refereed citations. The proposal should contain the URL to this bibliography. The Astrophysics Division recommends that the bibliography should be listed in sequence with the most recent refereed publications first. The bibliography should contain, as a minimum, the most recent (two to three years) papers, although it may list all papers for the lifetime of the mission. It is not required to list papers to American Astronomical Society (AAS) meetings, conferences, workshops, PhD theses, etc. If needed, these should be listed separately from the listing of the refereed papers.

6.6. Proposal submission deadline

The proposals will be uploaded electronically in PDF format to the NASA NSPIRES website and must be received by February 11, 2022, at 11:59 PM EST.

6.7. Further information required for the Senior Review deliberations

After the submission of proposals, members of the Senior Review panels may have further questions or requests for clarification. NASA will moderate these questions and requests, and expects to send them to the proposing teams at least one week before the start of the panel meetings and/or Senior Review Subcommittee meetings.

7. Additional Instructions for Chandra and Hubble Proposals

7.1. Scope

As stated in Section 2.2, the Senior Review Subcommittee will rank Chandra and Hubble alongside all the other missions. The 2022 Senior Review for these three missions will be a 'full' review (rather than a 'delta' review that was conducted for Hubble and Chandra in 2016). The review panels will fully assess the scientific merit and productivity of Chandra and Hubble and will also place additional emphasis on the operations, efficiency, and the science productivity given the costs for these missions.

7.2 Required elements

Proposers should fully follow all aspects of Section 6 when preparing their proposals, taking note of the following adjustments:

1. An additional section, entitled “Project’s Perspective on Operations and Efficiency” must be included. This section shall include:
 - a. An assessment of the current efficiency of science and mission operations with appropriate metrics and associated justification of the metrics, where appropriate.
 - b. A discussion of any plans to further improve the efficiency of science and mission operations over the next three to five years.
 - c. A discussion of how funds are presently used, to include FTE (and WYE) counts in each key functional area.
 - d. A description and justification of the management and decision processes that the project uses to apply the funding it receives to maximize science quality, observational efficiency, and return on investment, in an inclusive environment, nurturing a diverse community within and outside the project.
2. The combined proposal should not exceed 40 pages (including figures, figure captions, tables, and other graphics). Not included in the page limit are the appendices (see Section 6.3).

8. Panel Instructions

8.1 Review criteria

All proposals will be assessed against the following criteria:

Criterion A: scientific merit (50% weighting)

- Factor A-1:** Overall scientific strength and impact of the mission.
- Factor A-2:** Expected scientific output and science productivity given the costs over the requested funding period.
- Factor A-3:** Quality of information collection, archiving, distribution, and usability.

Criterion B: relevance and responsiveness (25% weighting)

- Factor B-1:** Relevance to research objectives and focus areas described in the SMD Science Plan and the 2020 Astrophysics Decadal Survey.

Factor B-2 Relevance to NASA's core value of Inclusion and alignment to SMD Science Plan Strategy 4.1. Specifically, the quality of plans and likelihood of success for nurturing the diversity of thought and background represented, a diverse community and an inclusive environment.

Factor B-3: Progress made toward achieving PMOs in the 2019 Senior Review proposal (for missions included in the 2019 SR). Performance of addressing any findings in the 2019 Senior Review (for missions included in the 2019 SR).

Criterion C: technical capability, management and science productivity given the costs (25% weighting)

Factor C-1: Overall operating cost and cost efficiency of the mission's operating model for proposed scientific goals.

Factor C-2: Health of the spacecraft and instruments, and suitability of the mission's operating model (e.g., governance, science team, instrument team, inclusion, diversity of thought and backgrounds represented) to maximize its scientific return.

The following scale will be used to map the number and significance of the strengths and weaknesses to an adjectival description for each of the three criteria above:

Adjectival description	Basis
Excellent	A thorough, and compelling proposal of exceptional merit that fully responds to the objectives of the CfP as documented by numerous or significant strengths and with no major weaknesses.
Very Good	A competent proposal of high merit that fully responds to the objectives of the CfP, whose strengths fully out-balance any weaknesses and none of those weaknesses constitute fatal flaws.
Good	A competent proposal that represents a credible response to the CfP, whose strengths and weaknesses essentially balance each other.
Fair	A proposal that provides a nominal response to the CfP but whose weaknesses outweigh any strengths.
Poor	A seriously flawed proposal having one or more major weaknesses that constitute fatal flaws.

8.2 Additional requested findings for Chandra and Hubble

The Chandra and Hubble panels are additionally requested to specifically provide

findings that address the following areas:

1. The science productivity and cost effectiveness of the observatory, and its associated operations center and infrastructure in enabling new science, archival research, and theoretical studies.
2. The efficiency of the science and mission operations processes, and identify any obvious technical obstacles to achieving the observatory's science objectives in the next five years.
3. The overall quality of observatory stewardship, and the usage of the allocated funds, in light of overall limited financial resources, to maximize science quality, observational efficiency, and return on investment.
4. Notable aspects that would enhance the science return of the mission within its available resources.

8.3 Panel charge

1. Use the above criteria to individually assess each project over the period (FY23, FY24 and FY25) and the extended period (FY26 and FY27) as described in Section 8.1 and 8.2.
2. Prepare a report, which will be used by the Senior Review Subcommittee to prepare findings to assist with an implementation strategy for the Astrophysics Division portfolio of operating missions for FY23 through FY27.

8.3 Meeting agenda

Separate agendas are provided for the Rest-of-Missions panel and for the Chandra and Hubble panels.

8.3.1 The Rest-of-Missions Review Panel agenda

Each mission will be allotted 60 minutes for an oral presentation to the panel. During each presentation, the project representatives should plan on using one hour of the allocated time for their prepared presentation, and reserving 60 minutes for questions and answers. To minimize the burden on projects, while also allowing for adequate expertise and support to be present, no more than three people may represent any one of the projects. These individuals must be direct representatives of the project itself, and not external affiliates. The project presentations should accomplish several objectives, in decreasing priority order:

- To provide a forum for questions from panelists and answers from the projects.
- To provide any significant updates; e.g., science results obtained since proposal submission.
- To re-emphasize the highlights of the proposals, bearing in mind that the

proposals have been read in detail by all panelists.

The Rest-of-Missions Panel will meet for four days and follow this agenda:

- Day 1: Instructions, program background, logistics (writing assignments, etc.), and a discussion of conflicts of interest and the procedures to minimize their impacts. Begin assessments of missions.
- Day 2: Project presentations, plus questions and answers;
- Day 3: Complete project presentations. Continue assessments and write draft report;
- Day 4: Finalize draft report.

8.3.1 The Chandra and Hubble panels agenda

The Chandra and Hubble panels will each meet for approximately 3.5 days and follow this agenda:

- Day 1: Morning: Instructions and logistics (writing assignments, etc.), and a discussion of conflicts of interest and the procedures to minimize their impacts. Discussion of initial impressions and findings.
Rest of the day: a formal oral presentation from the project (not to exceed 90 minutes) plus at least 120 minutes for questions and answers;
- Day 2: Site visit. Follow-up Q&A session with project as needed. Continue assessments
- Day 3: Additional discussions for clarifications with the project as needed. Begin writing and finalizing the draft report.
- Day 4: Additional discussions for clarifications with the project as needed.

8.5. Panel deliverables

The panel is required to produce a first draft of its report before the end of the meeting. The panel may then take an additional two weeks to finalize and submit its report to the Senior Review Subcommittee.

9. Senior Review Subcommittee instructions

The membership of the Senior Review Subcommittee will be drawn from the Chandra, Hubble, and Rest-of-Missions panels. The Terms of Reference (TOR) for the Senior

Review Subcommittee provides additional details and is available on the 2022 Senior Review Website.

10. NASA response

Starting in May through June 2022, following formal recommendations from the APAC and after consultation with stakeholders as appropriate, NASA HQ will contact each of the proposing missions/projects and relay direction resulting from the Senior Review. This direction may include new budget guidelines and other specific instructions resulting from the Senior Review process, possibly including notices of intent to terminate.

At this time, NASA HQ will post the report of the Senior Review Subcommittee, the Rest-of-Missions panel, the Chandra panel and the Hubble panel to a public NASA HQ website. NASA HQ will also post the formal recommendation from the APAC and its response.

Each of the projects will then submit back to NASA HQ their plan for complying with the new guidance and instructions. NASA HQ will ensure that key officials in participating international space agencies or other U.S. government agencies that are partners in a proposing mission are contacted and apprised of NASA's decisions resulting from the Senior Review.

11. Further Information

For further information, please contact:

Eric P. Smith
Chief Scientist
Astrophysics Division
Science Mission Directorate
NASA Headquarters
300 E Street SW, Washington DC 20546-0001
Tel: 202.358.2439 Cell: 202.436.5265
E-mail: eric.p.smith@nasa.gov

Rachele B. Cocks
Program Executive
Astrophysics Division
Science Mission Directorate
NASA Headquarters
300 E Street SW, Washington DC 20546-0001
E-mail: rachele.b.cocks@nasa.gov

11.1 Appendices

Appendix A includes one attachment as a MS Excel spreadsheet titled:

Appendix_A_mandatory_budget_summary_form.xlsx

Appendix B: Senior Review Generalized Question and Answer Log

11.2 Strategic/policy documents and other inputs

- [2022 Senior Review Website](#)
- [SCIENCE 2020-2024: A Vision for Scientific Excellence](#) (the SMD Science Plan)
- [Strategy for Data Management and Computing for Groundbreaking Science 2019-2024](#)
- 2021 Science Information Policy for the Science Mission Directorate ([Science Mission Directorate Policy](#)).
- 2020 Astrophysics Decadal Survey (to be linked when published)